

This is in response to the Amendment dated April 21, 2008. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office Action.

Response to Arguments

Claim Rejections - 35 USC § 103

I. Claims **20-22 and 25-28** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Schmidt** ("Structure and Properties of Copper Coating Electrodeposited at High Current Densities", *Galvanotechnik* (1991), Vol. 82, No. 11, pp. 3800-3818) in combination with **Morrissey et al.** (US Patent No. 6,679,983 B2) and **Ruythooren et al.** ("Electrodeposition for the Synthesis of Mircosystems", *J. Micromech. Microeng.*, Vol. 10 (2000), pp. 101-107).

With regards to claim **28**, the rejection under 35 U.S.C. 103(a) as being unpatentable over Schmidt in combination with Morrissey et al. and Ruythooren et al. has been withdrawn in view of Applicants' amendment. Claim 28 has been cancelled.

With regards to claims **20-22 and 25-27**, the rejection under 35 U.S.C. 103(a) as being unpatentable over Schmidt in combination with Morrissey et al. and Ruythooren et al. is as applied in the Office Action dated November 19, 2007 and incorporated herein. The rejection has been maintained for the following reasons:

- Applicants state that the combination of Schmidt, Morrissey et al., and Ruythooren et al. does not describe or suggest a process for electroplating copper on a

microelectronic workpiece in a through-mask plating application at rates of at least 2 $\mu\text{m}/\text{min}$ or between about 4 $\mu\text{m}/\text{min}$ to about 6 $\mu\text{m}/\text{min}$ wherein the thickness variation of the deposited features is less than 10%.

In response, Schmidt teaches that to determine the influence of the current density on copper plating, the current density was varied within a range from 5 to 200 A/dm^2 ($= 50$ to $2000 \text{ mA}/\text{cm}^2$) [Schmidt English translation, page 3, lines 16-17].

In the case where the claimed ranges overlap or lie inside ranges disclosed by the prior art, a *prima facie* case of obviousness exists (MPEP § 2144.05(I)).

There is a direct coherence of the deposit growth on the conductive layer with the current density. Thus, could Applicants say that the current density within a range from 5 to 200 A/dm^2 , e.g., $150 \text{ mA}/\text{cm}^2$, would not have deposited the copper onto the conductive layer at a rate of at least $2 \mu\text{m}/\text{min}$?

As to wherein the thickness variation of the deposited features is less than 10%,

(1) This is a physical characteristic of the plated deposit.

(a) The Schmidt combination teaches a similar process as presently claimed. Similar processes can reasonably be expected to yield products which inherently have the same properties. *In re Spada* 15 USPQ 2d 1655 (CAFC 1990); *In re DeBlauwe* 222 USPQ 191; *In re Wiegand* 86 USPQ 155 (CCPA 195).

(b) A process yielding a novel and nonobvious product may nonetheless be obvious (MPEP § 2116.01).

(c) The reason or motivation to modify the reference may often suggest what the inventor has done, but for a different purpose or to solve a different problem. It is not necessary that the prior art suggest the combination to achieve the same advantage or result discovered by the Applicants. *In re Linter* 458 F.2d 1013, 173 USPQ 560 (CCPA 1972); *In re Dillon* 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), *cert. denied*, 500 US 904 (1991); and MPEP § 2144.

- Applicants state that Schmidt does not describe that the “uniform structural” properties include thickness variation amongst features.
- Applicants state that Schmidt does not describe a process that forms features in each of more than one through-mask openings wherein thickness variation of the features is less than 10% with a standard deviation of 3.

In response, the rejection is not overcome by pointing out that one reference does not contain a particular limitation when reliance for that teaching is on another reference. *In re Lyons* 150 USPQ 741 (CCPA 1966). Moreover, it is well settled that one cannot show nonobviousness by attacking the references individually where, as here, the rejection is based on a combination of references. *In re Keller* 208 USPQ 871 (CCPA 1981); *In re Young* 159 USPQ 725 (CCPA 1968).

Ruythooren teaches that the final thickness of the resist should be at least equal to the final thickness that has to be obtained for the conductors (page 103, second column, lines 6-8).

Ruythooren teaches that the uniformity of the deposits, i.e., their thickness and, for alloys, their composition, can be difficult to obtain as it is influenced not only by the electrolyte composition but also by the pattern configuration [34] (figure 10), the electrode geometry [35] and the electrolyte hydrodynamics [11, 36, 37] (page 106, “4. Remaining challenges”).

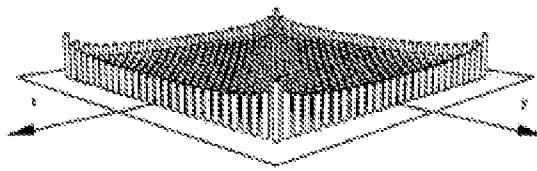


Figure 10. Calculated height distribution for a pattern of 28×28 small circular features.

Figure 10 shows a desired thickness of the features being the same, although the heights of the features are different.

Thus, the thickness variation of the features is a result-effective variable and one skilled in the art has the skill to calculate the thickness variation of the features that would have determined the success of the desired reaction to occur as taught by Ruythooren (page 106, “4. Remaining challenges”) [MPEP § 2141.03 and § 2144.05(II)(B)].

Applicants state that neither the secondary Morrissey et al. or Ruythooren et al. references describe achieving a thickness variation as recited in independent Claims 20, 29, 44, and 45.

In response, since the thickness variation of the features is a result-effective variable and one skilled in the art has the skill to calculate the thickness variation of the features that would have determined the success of the desired reaction to occur, the Schmidt combination teaches the resist (through-mask), electrolyte composition, and the electrolyte hydrodynamics as presently claimed. Thus, it is deemed that the Schmidt combination would have achieved a thickness variation as recited in independent Claims 20, 29, 44, and 45, absent evidence to the contrary.

II. Claim 23 has been rejected under 35 U.S.C. 103(a) as being unpatentable over **Schmidt** ("Structure and Properties of Copper Coating Electrodeposited at High Current Densities", *Galvanotechnik* (1991), Vol. 82, No. 11, pp. 3800-3818) in combination with **Morrissey et al.** (US Patent No. 6,679,983 B2) and **Ruythooren et al.** ("Electrodeposition for the Synthesis of Mircosystems", *J. Micromech. Microeng.*, Vol. 10 (2000), pp. 101-107) as applied to claims 20-22 and 25-28 above, and further in view of **Dubin et al.** (US Patent No. 5,972,192).

The rejection of claim 23 under 35 U.S.C. 103(a) as being unpatentable over Schmidt in combination with Morrissey et al. and Ruythooren et al. as applied to claims 20-22 and 25-28 above, and further in view of Dubin et al. is as applied in the Office Action dated November 19, 2007 and incorporated herein. The rejection has been maintained for the reasons as discussed above.

Applicants' remarks have been fully considered but they are not deemed to be

persuasive.

III. Claim 24 has been rejected under 35 U.S.C. 103(a) as being unpatentable over **Schmidt** ("Structure and Properties of Copper Coating Electrodeposited at High Current Densities", *Galvanotechnik* (1991), Vol. 82, No. 11, pp. 3800-3818) in combination with **Morrissey et al.** (US Patent No. 6,679,983 B2) and **Ruythooren et al.** ("Electrodeposition for the Synthesis of Mircosystems", *J. Micromech. Microeng.*, Vol. 10 (2000), pp. 101-107) as applied to claims 20-22 and 25-28 above, and further in view of **Tzanavaras et al.** (US Patent No. 5,421,987).

The rejection of claim 24 under 35 U.S.C. 103(a) as being unpatentable over Schmidt in combination with Morrissey et al. and Ruythooren et al. as applied to claims 20-22 and 25-28 above, and further in view of Tzanavaras et al. is as applied in the Office Action dated November 19, 2007 and incorporated herein. The rejection has been maintained for the reasons as discussed above.

Applicants' remarks have been fully considered but they are not deemed to be persuasive.

IV. Claims 29-31 and 34-37 have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Schmidt** ("Structure and Properties of Copper Coating Electrodeposited at High Current Densities", *Galvanotechnik* (1991), Vol. 82, No. 11, pp. 3800-3818) in combination with **Morrissey et al.** (US Patent No. 6,679,983 B2) and

Ruythooren et al. (“Electrodeposition for the Synthesis of Mircosystems”, *J. Micromech. Microeng.*, Vol. 10 (2000), pp. 101-107).

With regards to claim **37**, the rejection under 35 U.S.C. 103(a) as being unpatentable over Schmidt in combination with Morrissey et al. and Ruythooren et al. has been withdrawn in view of Applicants’ amendment. Claim 37 has been cancelled.

With regards to claims **29-31 and 34-36**, the rejection under 35 U.S.C. 103(a) as being unpatentable over Schmidt in combination with Morrissey et al. and Ruythooren et al. is as applied in the Office Action dated November 19, 2007 and incorporated herein. The rejection has been maintained for the reasons as discussed above.

Applicants’ remarks have been fully considered but they are not deemed to be persuasive.

V. Claim **32** has been rejected under 35 U.S.C. 103(a) as being unpatentable over **Schmidt** (“Structure and Properties of Copper Coating Electrodeposited at High Current Densities”, *Galvanotechnik* (1991), Vol. 82, No. 11, pp. 3800-3818) in combination with **Morrissey et al.** (US Patent No. 6,679,983 B2) and **Ruythooren et al.** (“Electrodeposition for the Synthesis of Mircosystems”, *J. Micromech. Microeng.*, Vol. 10 (2000), pp. 101-107) as applied to claims 29-31 and 34-37 above, and further in view of **Dubin et al.** (US Patent No. 5,972,192).

The rejection of claim 32 under 35 U.S.C. 103(a) as being unpatentable over Schmidt in combination with Morrissey et al. and Ruythooren et al. as applied to claims

29-31 and 34-37 above, and further in view of Dubin et al. is as applied in the Office Action dated November 19, 2007 and incorporated herein. The rejection has been maintained for the reasons as discussed above.

Applicants' remarks have been fully considered but they are not deemed to be persuasive.

VI. Claim 33 has been rejected under 35 U.S.C. 103(a) as being unpatentable over **Schmidt** ("Structure and Properties of Copper Coating Electrodeposited at High Current Densities", *Galvanotechnik* (1991), Vol. 82, No. 11, pp. 3800-3818) in combination with **Morrissey et al.** (US Patent No. 6,679,983 B2) and **Ruythooren et al.** ("Electrodeposition for the Synthesis of Mircosystems", *J. Micromech. Microeng.*, Vol. 10 (2000), pp. 101-107) as applied to claims 29-31 and 34-37 above, and further in view of **Tzanavaras et al.** (US Patent No. 5,421,987).

The rejection of claim 33 under 35 U.S.C. 103(a) as being unpatentable over Schmidt in combination with Morrissey et al. and Ruythooren et al. as applied to claims 29-31 and 34-37 above, and further in view of Tzanavaras et al. is as applied in the Office Action dated November 19, 2007 and incorporated herein. The rejection has been maintained for the reasons as discussed above.

Applicants' remarks have been fully considered but they are not deemed to be persuasive.

VII. Claim 44 has been rejected under 35 U.S.C. 103(a) as being unpatentable over **Schmidt** (“Structure and Properties of Copper Coating Electrodeposited at High Current Densities”, *Galvanotechnik* (1991), Vol. 82, No. 11, pp. 3800-3818) in combination with **Morrissey et al.** (US Patent No. 6,679,983 B2) and **Ruythooren et al.** (“Electrodeposition for the Synthesis of Mircosystems”, *J. Micromech. Microeng.*, Vol. 10 (2000), pp. 101-107).

The rejection of claim 44 under 35 U.S.C. 103(a) as being unpatentable over Schmidt in combination with Morrissey et al. (US Patent No. 6,679,983 B2) and Ruythooren et al. is as applied in the Office Action dated November 19, 2007 and incorporated herein. The rejection has been maintained for the reasons as discussed above.

Applicants’ remarks have been fully considered but they are not deemed to be persuasive.

VIII. Claim 45 has been rejected under 35 U.S.C. 103(a) as being unpatentable over **Schmidt** (“Structure and Properties of Copper Coating Electrodeposited at High Current Densities”, *Galvanotechnik* (1991), Vol. 82, No. 11, pp. 3800-3818) in combination with **Morrissey et al.** (US Patent No. 6,679,983 B2) and **Ruythooren et al.** (“Electrodeposition for the Synthesis of Mircosystems”, *J. Micromech. Microeng.*, Vol. 10 (2000), pp. 101-107).

The rejection of claim 45 under 35 U.S.C. 103(a) as being unpatentable over

Schmidt in combination with Morrissey et al. and Ruythooren et al. is as applied in the Office Action dated November 19, 2007 and incorporated herein. The rejection has been maintained for the reasons as discussed above.

Applicants' remarks have been fully considered but they are not deemed to be persuasive.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to EDNA WONG whose telephone number is (571) 272-1349. The examiner can normally be reached on Mon-Fri 7:30 am to 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Edna Wong/
Primary Examiner
Art Unit 1795

EW
June 7, 2008